

ABSTRACT OF THE DISCLOSURE

An optical filter using alternating layers of materials with "low" and "high" indices of refraction and deposited with atomic layer control has been developed. The multilayered thin film filter uses, but is not limited to, alternating amorphous layers of atomically controlled Si ($n = 3.56$) as the high index material and diamond-like carbon (DLC, $n = 2.0$) as the low index material. The Si layers are grown with a self-limiting pulsed molecular beam deposition process which results in layer-by-layer growth and thickness control to within one atomic layer. The DLC layers are produced using an ion-based process and made atomically smooth using a modified Chemical Reactive-Ion Surface Planarization (CRISP) process. Intrinsic stress is monitored using an in-situ cantilever-based intrinsic stress optical monitor and adjusted during filter fabrication by deposition parameter modification. The resulting filter has sufficient individual layer thickness control and surface roughness to enable ~ 12.5 GHz filters for next generation multiplexers and demultiplexers with more than 1000 channels in the wavelength range 1.31 - 1.62 μm .